Section 4
Water Supply Solutions with Countywide Applications

As part of the Central Puget Sound Regional Water Supply Outlook (Outlook), four work groups were established to investigate various types of regional solutions to municipal water supply shortfalls throughout the Central Puget Sound region. These work groups, composed of representatives from multiple stakeholder groups, have analyzed potential solutions that fall within the categories of water conservation, water reuse, stormwater utilization, and conventional supply options. Each of these approaches has the potential to contribute to meeting water supply needs in King County (County). However, some of them face significant hurdles prior to full-scale implementation. This section summarizes the work conducted in each of these solution categories, as presented in the 2001 Central Puget Sound Regional Water Supply Outlook. In addition, the water resource management technique of conjunctive use is discussed. Considered during the Outlook process as one of many conventional regional solutions, conjunctive use is highlighted here, due to its potential for optimizing the use of existing water supplies throughout King County.

Although presented in a regional framework, these potential solutions may also be applied to localized water supply shortfall areas. As discussed further in Section 5, individual utilities are investigating the potential for enhanced conservation, wastewater and stormwater reuse, and conventional regional supply options to address, in part, their future water supply needs.

4.1 Water Conservation

Water conservation is an increasingly important tool in managing municipal water supplies across the State and nation. Metropolitan areas in geographical settings as diverse as Denver, Los Angeles, and Boston have successfully used water conservation to help achieve their water supply objectives. Depending on the circumstances, conservation may offer opportunities to improve stewardship of watersheds and aquifers, reduce the need for new water sources, or postpone construction of pipelines, water treatment facilities, and other infrastructure. The Washington State Department of Health requires public water systems to address water conservation in the context of their Water System Plan. This includes requirements for metering water sources and deliveries, systematic data collection, conservation goals and objectives, evaluation of a specified set of water conservation measures including review of costs, benefits, and cost-effectiveness, and information on an implementation program, among other requirements. Conservation is

already being employed by most water systems in the County to manage demand. Continued efforts involving conservation can contribute to reducing the overall demand for water in the County, and may also assist in meeting localized needs where water supply shortfalls are projected.

4.1.1 Background on Water Conservation

Water conservation encompasses a range of activities, all designed to reduce water consumption or losses. Conservation measures typically vary depending on the type of water use involved. Some examples include:

- Residential: Reducing the quantity used for domestic purposes such as showering, toilet flushing, and clothes washing. Reducing outdoor uses such as irrigation of lawn and gardens.
- Commercial and Industrial: Reducing indoor uses such as process water, water-based cooling systems, and employee domestic uses. Reducing outdoor uses such as landscape irrigation and vehicle washing.
- Water System Operations: Reducing leakage from water mains and reservoirs. Reduce water used for flushing water mains and overflowing and cleaning reservoirs, while meeting water-quality objectives.

Water utilities serve communities that have different characteristics in terms of residential, commercial, and industrial activity. Therefore, conservation programs employed by water utilities to reduce demand can vary considerably. The measures used to reduce water consumption typically include elements such as distribution of water-efficient plumbing equipment or appliances; public information programs to encourage efficient use of water; and rate structures that provide an economic incentive for customers to reduce water use. Regulatory approaches such as the State plumbing code (see below) can also contribute to using water more efficiently.

As part of the Outlook, information was compiled on the extent of current water conservation activities in King, Pierce, and Snohomish Counties. There is considerable variation in the level of conservation activities implemented by different water utilities. Medium-sized to large water utilities (i.e., those serving 1,000 customers or more) have generally implemented more extensive conservation efforts, in comparison with the smaller utilities (less than 1,000 customers).

Examples of recent conservation activity within King County include:

- *Seattle Public Utilities and its wholesale customers* have taken a number of actions to conserve water in the last decade. Seasonal and/or inclined block rate structures were introduced by Seattle Public Utilities (SPU) and many of its purveyors starting in 1989, which have encouraged water

conservation through higher marginal rates, especially in the summer peak season. SPU and its purveyors also implemented a wide array of aggressive conservation programs including the installation of low-flow showerheads in 65 percent of the region's homes and various commercial incentive programs. Finally, SPU significantly reduced its non-revenue water through improved system operations (i.e., lining leaky reservoirs, reducing unnecessary reservoir overflowing, and main flushing, etc.) As a result of these actions (and the State plumbing code described below), annual average water consumption for SPU and its purveyors dropped 13 percent from 171 million gallons per day (mgd) in 1989 to 148 mgd in 2000. Considering that population was growing over the same period, the percent reduction in water use per person has been even greater: a 23 percent drop since 1989.

- *The City of Bellevue,* a wholesale customer of SPU, participates in a range of efforts sponsored by SPU and affecting residential and non-residential customers. Bellevue has also performed additional conservation activities, including a demonstration garden to promote conservation practices, and system-wide leak detection to identify and repair leaking water mains (losses were found to be less than 1 percent of total system demand).
- *Covington Water District* has an extensive outreach program to encourage efficient water use, and a sharply tiered rate structure that charges increasingly higher rates for additional blocks of water consumed. In addition, the District is beginning a program to require irrigation meters in new residential developments.

In addition to these examples, all water systems in the region are affected by the State plumbing code. The plumbing code was revised in 1993 to require water-efficient toilets, showerheads, and faucets in new construction and remodeling. As new development occurs, and as older construction is gradually renovated or replaced, the plumbing code will help to control overall demand for water.

4.1.2 Conservation Potential in King County

Although much conservation has already been done, many opportunities remain for additional conservation in King County. Using information from SPU's 1998 Conservation Potential Assessment (CPA), as well as Everett and Tacoma's conservation plans, the Outlook's Conservation Work Group examined the potential for future conservation savings and developed regional scenarios for levels of conservation effort over the next 20 years. The conservation scenarios were developed in relation to a "baseline" forecast of water demand developed in the Outlook. This baseline represents a "no-additional-conservation" alternative. It is based on projections of population

growth by the Puget Sound Regional Council (PSRC) and assumes that no additional conservation is undertaken in the region. However, it does take into account water savings expected to occur over time due to continued implementation of the plumbing code, discussed above. Thus, while King County population is projected to grow 22 percent over the next 20 years, the baseline forecast of King County water demand is for an increase of 14 percent.

Four scenarios were developed by the Outlook's Conservation Work Group. These are:

- *Scenario 1* assumes that all conservation programs already planned by the region's utilities through the year 2020 are carried out. This would include the "1% Conservation Program" being implemented by SPU and its wholesale partners (and designed to reduce per capita demand by 1 percent per year over ten years). This scenario would reduce projected 2020 demand by 9 percent countywide and would result in a still positive but much lower growth rate for regional water demand than the baseline forecast.
- *Scenario 2* assumes more conservation in addition to that already planned, and would reduce demand by 13 percent from the baseline 2020 forecast. This would be sufficient to achieve zero growth in water demand through 2020, completely offsetting the impact of population growth.
- *Scenario 3* assumes additional conservation programs at higher levels of intensity that would reduce demand by 18 percent from the baseline 2020 forecast and cause water demand to actually decline by 5 percent between 2000 and 2020.
- *Scenario 4* Assumes the highest level of conservation investment. It would reduce demand by 22 percent from the baseline forecast and bring 2020 water demand down by 10 percent below current levels.

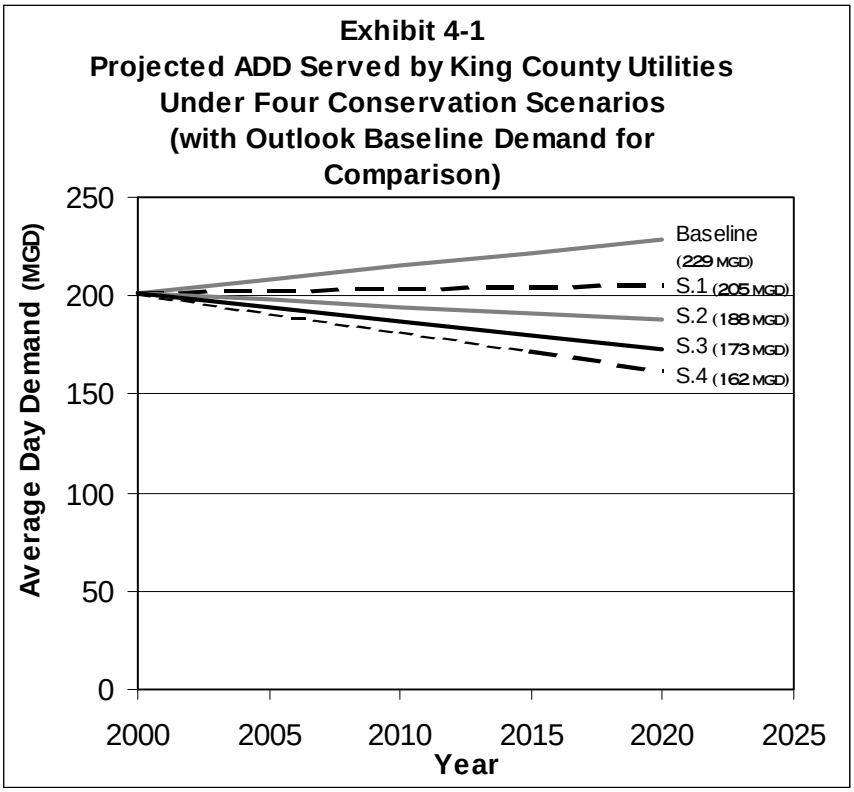
Exhibit 4-1 displays the demand projections resulting from the four conservation scenarios, in comparison with the Outlook's baseline demand projection. The information presented in Exhibit 4-1 represents municipal supplies in King County only, on an average day demand (ADD) basis.

The water savings presented in the scenarios are based on certain assumptions regarding participation rates by consumers. Generally, Scenarios 2 and 3 assume that 66 percent of each group targeted by specific conservation actions will participate[(1)]. Scenario 4 assumes an average participation of 77 percent. Participation rates for Scenario 1 are identical to

[(1)] For example, if a measure targets all households in the region, it is assumed 66 percent of all households will participate. In contrast, if a measure targets only single-family households with in-ground irrigation systems, it is assumed that 66 percent of these households will participate.

those assumed in the CPA (typically between 50 and 80 percent, depending on the individual measure involved). By way of comparison, conservation programs both locally and elsewhere in the nation have achieved 60 percent or more, at least for some program elements. These include SPU's regional showerhead program, which achieved 65 percent participation in less than one year.

Exhibit 4-1
Projected ADD Served by King County Utilities Under Four Conservation Scenarios (with Outlook Baseline Demand for Comparison)



As conservation intensity goes up, so do the costs. Utilities will implement low cost measures before those with much higher costs, and there are still many low cost measures that could be implemented. However, at some point additional programs and higher participation rates can only be achieved at a cost exceeding the value of the water saved[2]. Scenarios 1 and 2 would involve a mix of conservation programs with none costing more than about $3.00 per 1,000 gallons of peak season water saved (as estimated in the Outlook). Scenario 3 programs and intensity levels would have a much wider range of costs, starting at about $3.00 per 1,000 gallons and topping out at close to $40.00. The additional conservation in Scenario 4 would range between $40.00 and $80.00 per 1,000 gallons of peak season water saved.

[2] The value of water for assessing conservation programs is generally defined as the peak season marginal cost of new supply resources. Often, an "environmental premium" is added to the marginal cost to reflect environmental costs of new supply projects that are often difficult to quantify. In Seattle's Conservation Potential Assessment, published in 1998, the peak season marginal cost of water was estimated to be $2.41 per ccf (or $3.22 per 1,000 gallons). For comparison purposes, retail rates for summer water in King County range from about $2.00 to $6.50 per 1,000 gallons.

Further discussion of the conservation scenarios and associated issues is provided in the 2001 Central Puget Sound Regional Water Supply Outlook.

4.1.3 Key Issues Related to Conservation

A number of key issues remain to be addressed if additional conservation is to be successful in the region. Many of these issues relate to fundamental aspects of implementing conservation on a local and regional basis. The following is a list of such issues that are discussed in the Outlook:

- Political acceptance of conservation objectives and approaches
- Education and outreach
- Effects of pricing and rates on consumer choices
- Methods for evaluating economic aspects of conservation
- Balancing regional coordination with local control
- State water law
- State role in promoting conservation
- Coordination between land-use management and water-resource management

4.1.4 Application of Conservation to Identified Needs in King County

Water conservation is one technique in managing municipal supplies for King County. As shown by the conservation scenarios discussed above, conservation can have a significant impact on demand. The cost of implementing conservation programs can vary greatly, depending on how much conservation a utility has already done and how much additional water a utility is trying to save.

For utilities with projected demand in excess of what their existing water resources can supply, additional conservation can be at least part of a solution. Typically, each water utility weighs the costs and benefits of conservation in comparison with alternative solutions, such as purchase of wholesale supplies, development of new sources of supply, or water reuse. In some cases, conservation may reduce, but not eliminate, the need for increased supplies. Water supply solutions for individual utilities with possible water supply shortfalls are discussed in greater detail in Section 5.2.

4.2 Water Reuse

The beneficial reuse of treated wastewater offers yet another solution to the potential future water supply needs of both the region as a whole and for localized shortfall areas. The concept of reuse, otherwise known as water reclamation, is fairly new to the Pacific Northwest region, though not to other areas such as the

arid southwestern states. Reuse involves utilizing adequately treated wastewater typically for non-potable purposes, such as irrigation and industrial process water. By using this as a source of water, the demand for potable drinking water could be reduced, providing relief for the raw water supplies in the region. In addition, application of highly treated reclaimed water for potable purposes may be an option, though with many more regulatory and public perception issues.

In order to investigate the potential of reuse in the Central Puget Sound, the Reuse Work Group was formed as part of the Outlook process. The work group has examined the regulatory framework surrounding reuse in this region, summarized current reuse projects, identified drivers, constraints, and issues associated with use of reclaimed water, and performed a preliminary analysis of reuse potential in the area. This work is summarized in the 2001 Central Puget Sound Regional Water Supply Outlook.

In RCW 90.46, the Reclaimed Water Act, the State declares that "...the people of the state of Washington have a primary interest in the development of facilities to provide reclaimed water to replace potable water in nonpotable applications... to assist in meeting the future water requirements of the state." As part of the regulatory framework for reuse, King County has adopted policies that support continued investigation into water reuse opportunities and allow for funds to be used in the development of one or more satellite treatment plants that may produce reclaimed water. The King County Council has directed, as part of its Regional Wastewater Services Plan, that use of reclaimed water be expanded. It is also part of the planning for the third regional wastewater treatment plant that is now in the process of being sited.

As a major water supplier in the region, SPU has addressed the issue of reuse in its Draft 2001 Water System Plan (WSP) by stating that it recognizes the value of reclaimed water in reducing the demand upon potable water supplies, and encourages reuse to be a part of coordinated regional water resources planning efforts.

By the policies and statements issued by these major water resource players in the County, it is evident that water reuse is becoming a more integral part of sound water resources management in the County area. This is further supported by the many reuse projects that are in various stages of development throughout the Central Puget Sound Region (see Table 4-1).

As shown in Table 4-1 there are four operational projects that may directly benefit the County area in various ways, such as reducing the potable water demand for irrigation and augmenting stream flows. These projects include the City of Snoqualmie golf course irrigation, West Point and Renton wastewater treatment plants (in-plant use and irrigation), and Fort Dent Park ballfield irrigation.

Table 4-1
Regional Water Reuse Projects

Project	Status	Intended Use	Amount of Water Available (mgd)
Reuse Projects with Potential Direct Benefit to the King County Area			
City of Snoqualmie - golf course	Operational 2000	Irrigation - golf & public landscaping	1.5
West Point treatment plant	Operational 1994	In-plant use & irrigation - public landscapes	0.7
Renton treatment plant	Operational 1996	In-plant use & irrigation - public landscapes	1.3
Fort Dent Park in Tukwila	Operational	Irrigation - ballfields	0.1
Lakehaven Utility District-Mirror Lake	Planning / Development	Ground water recharge through septic systems	0.7-2.0
Pilot satellite plant	Planning / Development	Non Potable	3
Reuse Projects with Potential Indirect Benefit to the King County Area (1)			
Poplar tree farm (near Everett)	Planning / Development	Irrigation - tree farm	1.5
Kimberly-Clark paper mill	In Design	Non contact cooling in heat exchanger	4
Everett Parks	Feasibility Stage	Irrigation - golf & parks	Unknown
Nursery (near Everett)	Feasibility Stage	Irrigation - plants	Unknown
Orting	Planning / Development	Irrigation - golf, school, parks	1
Crystal Mountain	Planning / Development	Snowmaking & Irrigation - landscape	0.1
Mt Rainier Resort-Park Junction	Planning / Development	Irrigation - golf/public landscape & HVAC	0.1
Simpson Tacoma Kraft Mill	Feasibility Stage	Non Potable	10
Stone Consolidated Mill	Feasibility Stage	Non Potable	5.2

(1) Although not located in King County, these projects may beneficially impact the County area by increasing the amount of potable water that may be shared regionally.

Two projects listed in Table 4-1 are currently in the planning and development stage and have the potential for directly benefiting the County area. These projects are summarized below.

- *Lakehaven Utility District – Mirror Lake Aquifer Recharge.* The Lakehaven Utility District (Lakehaven) is reviewing the possibility for sewering an area with a low-pressure sewer system and at the same time installing reclaimed water mains to collect water and use it for aquifer recharge purposes. If approved by the Board and the homeowners, Lakehaven would install a reclaimed water line to the existing on-site septic systems to utilize the leaching field of the homeowner after the homeowner has connected to the Lakehaven sewer system. The estimated recharge potential is between 0.7 and 2 mgd and the capital cost is estimated to be $6-8 million, although some oversizing was done as this facility would be part of a regional project.
- *Technology Assessment Demonstration.* The objective of this project, led by the King County Department of Natural Resources, is to develop information regarding the effectiveness, operability, and costs of technologies. There are two components to this project, as follows:

  1) Development of bench-scale technology demonstrations at the West Point regional wastewater treatment plant to develop data and operating experience needed to assess the benefits and costs of implementing wastewater reclamation projects.

  2) Development of a satellite demonstration project in the Sammamish Valley. The project, the Sammamish Valley Reclaimed Water Production Facility, will be a 1 to 3 mgd skimming plant designed to produce reclaimed water directly from the local sewer interceptor using the latest technology. The reclaimed water produced will be used by local water users to reduce direct diversions from the surface and ground water, leaving more water in the Sammamish River for migrating salmon.

  Selected technologies will be demonstrated at the County's West Point regional wastewater treatment plant to develop data and operating experience needed to assess the benefits and costs. Potential reductions in potable water demand are estimated at 3.0 mgd.

A number of additional projects outside King County were identified by the Work Group. These may have indirect benefits to King County, with regard to regional water management.

Table 4-2
Drivers and Constraints for Reclaimed Water

Issue	Driver	Constraint
Regulatory Issues		
State & federal regulations create legal framework.	✓	✓
State law strongly encourages whenever feasible.	✓	
Required consideration during wastewater planning.	✓	
Technical Issues		
Increasingly stringent wastewater disposal requirements	✓	
Proximity of reclaimed water customers to treatment facility.		✓
Expense of retrofitting existing systems.		✓
Increasingly stringent wastewater disposal requirements.	✓	
Location of existing and proposed facilities.	✓	✓
Types and location of existing and potential customers.	✓	✓
Extent of customer demand for reclaimed water.	✓	✓
Requirements/timing of utility upgrades.	✓	✓
Requirements/timing for construction of new facilities.	✓	✓
Environmental Issues		
Environmental benefits.	✓	
Concerns with streamflow augmentation.		✓
Concerns with diversion of discharge to streams.		✓
Wetland mitigations/enhancement.	✓	
Legal Issues		
Concerns over perception of increased liability exposure.		✓
Concerns about relinquishing water rights.		✓
Financial Issues		
Cost of reclaimed water.		✓
Perception of potential lost revenue/stranded costs.		✓
Public Acceptance Issues		
Rate of public acceptance is generally strong.	✓	✓
Strong environmental ethos in Puget Sound region.	✓	
Public education can help gain support.	✓	
Political Issues		
Requiring use, or consideration of, reclaimed water.	✓	
Providing general support.	✓	
Providing financial support.	✓	
Administration, coordination between utilities.	✓	✓
Configuration of the utility industry.	✓	✓

As part of their efforts, the Reuse Work Group identified drivers and constraints for the development and use of reclaimed water. Drivers support or direct reclaimed water use. Constraints limit the applicability of reclaimed water use. The issues are divided into seven categories: water quality regulations, technical, environmental, legal, financial, public acceptance, and political. Table 4-2 briefly summarizes these issues. Further discussion is provided in the Outlook document.

4.3 Conjunctive Use

The amount of water that can be reliably produced when two or more sources of supply are linked together and operated as a single system is often more than if the sources were operated separately. This phenomenon is referred to as "*conjunctive use*."

Consider two neighboring water systems, System A with a surface water source and System B with a groundwater source. System A's yield is constrained by peak season instream flow requirements and is highly variable from year to year due to wide differences in annual rainfall and snowpack. System B has plenty of capacity to meet peak day demand but is limited by sustainable annual yield less than its annual water right. Both systems are facing growing demand that has almost reached their supply capacity. One solution to their problems would be to link their systems and operate them conjunctively. System A has always had much more water available in the winter than it has needed. With the systems linked, it could now provide water to System B each winter, allowing System B to meet its demand while reducing the annual production from its own wells. In addition, System A could further supplement System B's supply during wet years when there was plenty of water in the river to meet instream flow requirements, resting the aquifer and allowing it to recharge. Then, when a dry year drastically reduces the water available from System A's surface water source, System B could return the favor by temporarily drawing more heavily on its wells and supplementing System A's peak season supply.

While the term conjunctive use usually applies to the benefits of linking surface- and ground water systems together,[3] operating two surface water systems conjunctively can also produce benefits. For example, Seattle Public Utilities (SPU) balances the use of the Cedar and South Fork Tolt water sources depending on the hydrologic conditions at each of the sources. Although the two watersheds are not far apart geographically, they often experience different hydrologic conditions. When water conditions are better in one watershed than the other, more water will be diverted from that source in that year. The resulting system-wide yield is higher than if each source were operated independently of the conditions at the other

[3] The following definition can be found in Coe JJ. 1990, "Conjunctive Use - Advantages, Constraints and Examples," *Journal of Irrigation and Drainage Engineering*, 116, 3, pp 427-443: "Conjunctive use of surface and ground waters can be defined as the management of surface- and ground-water resources in a coordinated operation to the end that the total yield of the system over a period of years exceeds the sum of the yields of the separate components of the system resulting from an uncoordinated operation."

source. SPU estimates that managing its system conjunctively boosts firm yield by approximately 5 percent.

There are numerous opportunities within King County and the region to reap conjunctive use benefits, of which the Tacoma Second Supply Project is just one example. The interconnection with Seattle's system will not only link the Seattle and Tacoma surface water sources, but also the Seattle system with Tacoma's groundwater source. This would make possible a form of long-term conjunctive use sometimes referred to as *cyclic storage*. In most years, the Seattle system would not need its share of water from the Green River and would let Tacoma use it to rest its aquifers and recharge its groundwater storage. In the occasional dry year, when less water was available from surface sources, Seattle would take its share from the Green plus part of Tacoma's share. Tacoma would then draw more heavily from its groundwater source – something made possible by having used less groundwater in previous years.

In general, conjunctive management of multiple supply sources can achieve a higher total firm yield than the isolated management of each individual supply system. It allows more water to be produced from existing sources with little or no adverse environmental effects. Thus, in some cases, conjunctive use can provide a reliable alternative to new source development.

4.4 Conventional Supply Options

The Outlook's Conventional Supply Options and Institutional Constraints Work Group was formed to identify water supply projects that will increase the amount of water available to meet the needs of the region, and to investigate the institutional barriers to implementation of such options. This section summarizes the work of the group as presented in the 2001 Central Puget Sound Regional Water Supply Outlook.

While the work group has analyzed the conventional supply options from a regional perspective, it should be noted that these projects also provide potential solutions for localized areas having water supply needs. As further discussed in Section 5, many utilities are looking to these conventional regional supply options to address, in part, their anticipated future water supply shortfalls.

Conventional supply options are defined to include the following types of projects:

- Extraction of water from new ground or surface water sources;
- Extraction of additional water from existing ground or surface water sources;
- Storage of water (reservoirs, aquifer storage and recovery, etc.) which makes more water available when it is needed;
- Connection of systems through interties; and,

- Non-traditional, conceptual options that are not currently promoted by any water utility in the Puget sound region, but that represent emerging technologies and approaches to water supply. As an example, desalination is currently viewed as too costly for implementation in this region. However, desalination may become a more competitive option in the future and could be used as a benchmark for evaluating costs and other implementation considerations of future supply alternatives. Non-traditional options of water reuse, conjunctive use and stormwater utilization are discussed elsewhere in Section 4.

As potential solutions have been identified, they have been evaluated by the following set of criteria in order to provide a basis for comparison among the solutions:

- Technical (quality, quantity, location, availability, ability to develop, etc.);
- Environmental (direct and indirect impacts on environment, competing uses, compatible uses, adaptive management, sustainability, etc.);
- Legal (interpretation of legal options, uncertainty of legal status, regulatory vs. factual constraint, etc.);
- Financial/Economic (capital and operating costs, indirect costs, environmental mitigation, societal costs, etc.); and,
- Political/Social (subregional versus local, regional versus State, Growth Management Act (GMA) versus Endangered Species Act (ESA), adaptive versus regulatory, etc.).

4.4.1 Regional Options

As presented in the Outlook document, 17 specific regional water supply options have been identified by major Central Puget Sound water suppliers. It is typical for water utilities to explore multiple future supply options with the understanding that only a limited number will be developed as potential water supplies. Table 4-3 presents a list of the conventional regional supply options that could potentially benefit water users in the King County area, along with the lead agency that has investigated the potential solution, the level of permitting and planning status, and the amount of available water estimated to be gained from implementation. It is unlikely that all of these options will be pursued, because in the aggregate they would exceed anticipated future demand, and because some of them would likely meet significant technical, legal, or other problems. Appendix E contains detailed descriptions of these proposed projects, summarized from information in the Outlook.

Table 4-3
Conventional Regional Supply Options

Supply Option	Lead Agency	Planning & Permitting Status	Average Annual Firm Yield (mgd)
Regional Supply Options with Direct Benefit to the King County Area			
Tacoma Second Supply Project (TSSP)	Tacoma Water	I	28 (1)
Cedar River Dead Storage	Seattle Public Utilities	II	39
Lake Youngs Drawdown	Seattle Public Utilities	II	20
Oasis Aquifer Storage and Recovery Project	Lakehaven Utility District	II	78
South Fork Tolt Additional Drawdown	Seattle Public Utilities	II	8
Snoqualmie Aquifer Project	East King County Regional Water Association/Seattle Public Utilities	II	16
Auburn Subregional Ground water Supply	Auburn	III	TBD
Lake Washington Diversion	Shoreline Water District	III	TBD
North Fork Tolt Diversion Project	Seattle Public Utilities	III	40
Everett/Seattle Public Utilities Intertie	Everett/Snohomish County PUD	IV	20 (could be transferred from Everett to SPU)
Weyerhaeuser Water Right	Snohomish River Water Authority	III	29 (3)
Lake Tapps Project	Puget Sound Energy	III	66
Regional Supply Options with Potential Indirect Benefit to the King County Area (2)			
French Creek Aquifer Storage and Recovery Project	Northshore Utility District	III	25 (Qi)
Sultan Basin Expansion Project	Everett/Snohomish County PUD	IV	64
Chambers Creek Properties Project	Pierce County	II	14
Central Pierce County Source Development and Intertie Program	Pierce County Cooperative	III	~5

Notes:
TBD: To Be Determined.
(1) This is the total amount allocated to utilities in King County (SPU, Kent, Covington, and Lakehaven). The total amount of supply available from the TSSP is approximately 42 mgd, with the balance allocated to Tacoma, in Pierce County.
(2) Although not located within King County, these supply projects may beneficially impact the County by increasing the amount of water shared regionally.
(3) Total amount to be allocated among Everett, Woodinville, and Northshore Utility District. Only the two latter utilities are located in King County.

The following classifications were made to describe the permitting and planning status of each project:

- Status I: Under design and proceeding toward construction, with all or most permitting complete.
- Status II: Preliminary design completed and major permits applied for.
- Status III: Some planning initiated and/or new technology option being pursued – proponent identified, some, but not all permits applied for.
- Status IV: Conceptual – no planning initiated.

The specific options identified include projects in King, Pierce, and Snohomish Counties. However, all of these have potential relevance to the King County area under the concept that new approaches for efficient water resource management may be developed which allow water to be moved within the region more easily. The only project assigned a planning and permitting status classification of "I" is the Tacoma Second Supply project which is described in the next section. Descriptions of other conventional supply options identified in the Outlook can be found in Appendix E.

4.4.2 Second Supply Project

Of the options listed in Table 4-3 as having potential direct benefits to the King County area, the Tacoma Second Supply Project (TSSP) is the only one with a Planning and Permitting Status of I. After many years of planning, this project is now being implemented by Tacoma Water, and therefore warrants further discussion. The following description of the TSSP is adapted from the Outlook document. Full descriptions of the other conventional regional supply options may also be found in the Outlook document.

In essence, the TSSP will significantly expand the supply capacity from the Green River into Tacoma. An element of the project is the North Branch pipeline (formerly referred to as the Tacoma-Seattle Intertie Pipeline), which will convey water from Tacoma's Second Supply Pipeline north to Lake Youngs, augmenting SPU's supply capacity. The pipeline will also be able to convey water south from SPU's system to benefit the Tacoma area in case of a water supply emergency. Kent and Covington will also obtain water from taps off of the North Branch Pipeline, while Lakehaven Utility District will obtain water from the TSSP. SPU, Kent, Covington, and Lakehaven will all participate in the project, but it will be owned and operated by Tacoma Water.

Tacoma Water has a permit to divert up to 65 mgd from the Green River for use in the TSSP. This project primarily involves developing more storage capacity behind Howard Hanson Dam; allowing water collected in the rainy season to be used during the dry season. Additional instream flow requirements for the project have been provisionally established in an agreement between Tacoma Water and the Muckleshoot Indian Tribe,

limiting allowable diversions during the summer. As a result, on an average annual basis, diversions from the Green River are expected to range between approximately 40 to 45 mgd. One-third of the water will be allocated to Tacoma, one-third to Seattle, and one-ninth to each of the participating south King County utilities (Kent, Covington, and Lakehaven).

This project will enhance the efficiency of SPU and Tacoma Water's current water supply systems by making use of existing sources and allowing SPU and Tacoma Water to share and allocate water storage in a manner that benefits each utility and instream resources. Under a bilateral agreement between the two utilities, SPU will get more water from storage at the Howard Hanson Dam in dry years, when Tacoma Water will be able to utilize its ground water source more heavily. This conjunctive use of the two water systems optimizes the overall amount of water provided to SPU and Tacoma Water for municipal and instream uses. For example, this additional supply will increase Seattle's firm yield by 14 mgd.

A Memorandum of Agreement (MOA) has been developed between the five partner water suppliers and Ecology and DOH. With the MOA, Ecology approved the extension of Tacoma's second diversion water right and the five partner water suppliers committed to the following:

- Coordinate management and planning of their water resources within the area that encompasses the authorized place of use of water under Tacoma's Second Diversion Water Right;
- Work with the Central Puget Sound Water Suppliers' Forum to develop water supply and demand projections and to continue to work with the Forum's conservation work group, or similar mechanism to develop and implement effective conservation methodologies;
- Coordinate in developing their water system plans, and participate in other regional water supply planning activities in the region;
- Promote increased water use efficiency, including achieving a cumulative aggregate (retail and wholesale) reduction in water use by 10% over a ten year period beginning January 1, 2000;
- Conduct a conservation potential assessment, if they have not already done so, within the boundaries of their respective planning areas; and,
- Work jointly to develop practical and effective local and regional alternatives to resolve identified streamflow problems resulting from water supply operations that adversely impact threatened or endangered fish.

The TSSP was approved by the Tacoma Public Utility Board in October 2001. Approval by the Tacoma City Council followed shortly thereafter.

4.5 Stormwater Management and Utilization

4.5.1 Background on Stormwater Management and Utilization

Stormwater management and utilization is another option to help King County meet future water demands and supplement potable water supply. With a growing population and increase in environmental regulations more efforts are needed to manage water demands and improve stormwater practices. Storage of runoff for later use and decreasing runoff by reducing the amount of impervious surface are the two primary stormwater management practices affecting water supply. The benefits from stormwater management include decreasing winter peak flows to downstream systems, ground water recharge and infiltration, decreasing potable water demand, and some water quality benefits. The Outlook convened a Stormwater Work Group to identify future stormwater management options that may help supplement water supply in the tri-county region.

With growth and development in the King County area, the amount of impervious surface created by buildings, parking lots, and roads continues to increase. As a result, the impervious surface creates high stormwater flows as the natural infiltration process is impeded with the removal of vegetation and permeable surfaces. Impervious surface decreases the rate and volume of ground water recharge, increases erosion, and increases the frequency and duration of high stream flows.

Historically, stormwater control was developed to reduce health and safety risks, and cost. Conventional stormwater treatment methods in the King County area have focused on diverting and collecting stormwater to be released into natural waterways or in some cases treated. This practice addresses impacts to hydrology and water quality but does not address the loss of the natural hydrologic function. Stormwater management to supplement water supply is an attempt to increase or mimic natural hydrologic function.

4.5.2 Stormwater Management Options

The general stormwater management options discussed in Table 4-4 were identified by the Outlook's Stormwater Work Group as the most significant and/or likely to be implemented in this region. A set of criteria for profiling stormwater management options was developed including technical, environmental, legal, financial/economic, and political/social issues surrounding the stormwater management options. The following table summarizes the stormwater management options including a description of water rights requirements, water supply/environmental benefits, and project constraints/implementation issues. The type of options range from large scale pre-development planning issues such as reducing impermeable surface using low impact development, to providing smaller scale projects on previously developed areas for storing stormwater for later use. Additional information on these stormwater management options can be found in the 2001 Central Puget Sound Regional Water Supply Outlook.

Table 4-4
Stormwater Management Options

Generic Management Option	Water Rights Issues	Water Supply/ Environmental Benefits	Project Constraints/ Implementation Issues
Onsite storage for summertime irrigation and stream augmentation	Water right required for diversion to and withdrawal from storage facility.	Summertime irrigation water and stream augmentation.	Large land area required for storage facilities. Environmental permitting for withdrawals from streams.
Pipe outfalls for direct injection to well fields or to storage facilities	Water rights may be required for withdrawal from ground.	Summertime irrigation water. Recharge groundwater. Decrease stream flows during the wet season.	Environmental permitting for discharging of stormwater to ground. Water quality constraints related to injection into wells.
Redesign of street right-of-ways	None.	Decreased impervious areas decreases peak flows, design allows for increase in time for runoff to enter streams, provides water quality benefits, may promote better infiltration where soils allow.	Public acceptance. Changing established design standards for street widths. Safety considerations and emergency access related to roadway width.
Use or keep stormwater generated onsite at the site.			
Collection of roof runoff to flush toilets	Possibly required.	Uses non-potable roof runoff to augment potable water supply by using stormwater runoff that that would otherwise enter the Combined Sewer System or the existing storm drain system.	Prevention of back flow to potable water source and other Department of Health concerns.
Collection of roof runoff `for irrigation	Possibly required.	Augments potable water supply.	*Requires land for storage facility.*
Infiltration / dispersion BMPs	None required.	Promotes infiltration to recharge groundwater. Decrease winter peak flows.	*Creating localized drainage problems such as flooding, wet basements, etc.*
Vegetated roofs	None required.	Decreases winter peak flows to downstream systems.	*More expensive than conventional roof systems.*
Soil amendments	None required.	Decreases winter peak flows to downstream systems. Promotes infiltration, soil water retention. Decreases demand for irrigation.	*More upfront cost for purchase of soil amendments.*
Low Impact Development (LID) *BMPs including grass roofs, one sidewalk, permeable sidewalks, shared driveways, landscaped cul-de-sacs, 10' front setbacks, reduced lot size, and one way lanes.*	None required.	Promotes infiltration, soil water retention. Decreases demand for irrigation.	Public safety/emergency vehicle access will be a concern as will: community acceptance, acquisition of water rights, the potential for out of basin transfers, reliably quantifying groundwater recharge benefits, GMA compatibility and high unit cost for some LID options.
Locating and using gravel pockets for percolation	Depending on source of water, may be required.	*Decreases winter peak flows to downstream systems. Increases summer time streamflows. Recharges ground water table.*	Creating localized drainage problems such as flooding, wet basements, etc.
Retrofitting stormwater systems in highways and other roadways	None required.	*Provides stormwater control and treatment to developed roads built prior to existing stormwater regulations.*	

In the King County area several of the stormwater options listed in Table 4-4 have been successfully implemented. One example includes a stormwater collection facility at the King Street Center located in Seattle at 201 South Jackson Street. The stormwater is used to supply toilets with flushing water in the building. This project reduced the building's flushing budget by 1.4 million gallons a year, or by 64 percent. Another example is the Sea-Street project located in the Ballard area designed to minimize the impervious surface and promote infiltration. This project helped mitigate stormwater runoff from a single-family residential area by designing a meandering road with reduced impervious surface and the use of native vegetation and vegetative swales on both sides of the road. As a result, the impact of the development on salmon-bearing Pipers Creek was minimized.

The use of stormwater to augment water supplies is a new approach for the King County area requiring changes to policy and development practices, which present several challenges. A focus of stormwater management is to reduce the amount of impervious surface and enhance the natural infiltration opportunities for stormwater. Since much of the County is already developed, the opportunity to implement stormwater management practices associated with new development is reduced.

Stormwater quality is another concern when looking at the various options. Stormwater runoff from roadways and parking lots often contain many types of pollutants such as oils, heavy metals, and sediment. Stormwater containing these pollutants may not be suitable for stream augmentation or other types of uses.

The cost of implementing some of the stormwater options is a factor that may inhibit the use of these practices. In many cases the cost of the stormwater option is higher than the alternative, conventional option, making a regulatory requirement or incentives important in the implementation and use of these practices.

4.5.3 Current and Future Stormwater Regulations

As the importance of improving urban water quality and the environment increases, regulatory agencies are revising standards to address those needs. There are several federal, State, and local regulations that address stormwater runoff as summarized in Table 4-5. Further detail on the agencies and regulations can be found in the 2001 Central Puget Sound Regional Water Supply Outlook.

Table 4-5
Stormwater Regulations

Regulatory Issue	Description/Comment
Puget Sound Water Quality Management Plan	Requires all cities and counties in the Puget Sound Basin to develop stormwater management programs.
Shoreline Permit	Controls development in shoreline areas.
Phase I NPDES (and State Waste Discharge Stormwater Permits for Municipalities)	Provides a mechanism for monitoring the discharge of pollutants to waters of the United States and for establishing appropriate controls.
Phase II NPDES and State Waste Discharge Stormwater Permits for Municipalities	Includes additional communities than under Phase I and requires the Phase II communities to submit their stormwater programs to comply by March 2003.
Endangered Species Act: (Section 4(d) Rules, Section 7 Consultations, Section 10 Habitat Conservation Plans)	The manner in which the ESA will impact urban stormwater management is still evolving.
Section 401 Water Quality Certifications: (Section 404 of the Clean Water Act)	Required for projects that require a fill or dredge permit under Section 404 of the Clean Water Act. Ecology must certify to the U.S. Army Corps of Engineer (the permitting agency) that the proposed project will not violate water quality standards.
Hydraulic Project Approvals (HPAs): (Chapter 75.20 RCW, the Hydraulics Act)	The Washington State Department of Fish and Wildlife has the authority to require actions of projects whose stormwater discharges would change the natural flow or bed of state waters.
Aquatic Lands Use Authorizations	The Department of Natural Resources (DNR) may require a stormwater outfall to have a valid use authorization and may require the outfall to avoid or mitigate resource impacts.
Underground Injection Control Authorizations/Permits	To implement provisions of the federal Safe Drinking Water Act, Ecology has adopted rule (Chapter 173-218 WAC) for an underground injection control program. To date, Ecology's activity under this program has been primarily in regard to getting all UIC wells registered.
Other Local Government Regulations	Local governments have the option of applying more stringent requirements than those in the Ecology Stormwater Manual.

The King County area can potentially benefit from the use of stormwater management and utilization to augment water supply. However, there are several issues that need to be addressed before these practices can be implemented throughout the County. Entities responsible for stormwater management must communicate and coordinate to determine how these

practices can best be used to offset potable water demand. Once these practices are determined, plans, policies, and regulations should be reviewed to encourage and require these practices.

Elements identified by the Outlook's Stormwater Work Group as potentially requiring attention include:

- Regulations regarding development with minimal impervious surface.
- Capital improvement programs and Phase I NPDES permits to include stormwater management facilities and improvements.
- Regulations regarding on-site collection, storage, and infiltration facilities for stormwater.
- Regulations regarding inspection and maintenance of stormwater management facilities.
- Legal and water rights issues which will facilitate implementation of stormwater management options.